

Validation and Use of PANS for Vehicle Aerodynamics and Active Flow Control

G. Minelli, B. Basara, S. Krajnović

minelli@chalmers.se



CHALMERS
UNIVERSITY OF TECHNOLOGY



15%



70%

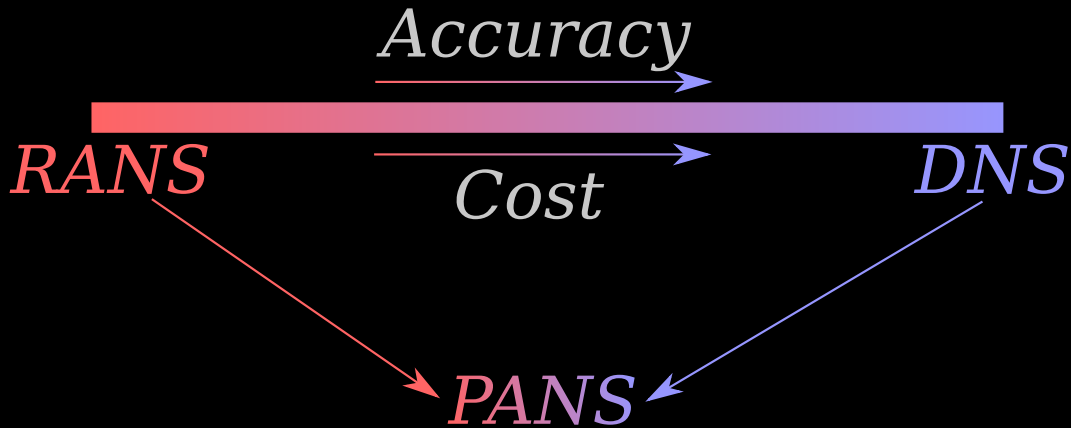


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$$f_k = \frac{1}{\sqrt{C_\mu}} \left(\frac{\Delta}{\Lambda} \right)^{\frac{2}{3}} > \frac{k_u}{k}$$

$\sqrt[3]{\Delta_x \Delta_y \Delta_z}$

$\frac{k^{3/2}}{\epsilon}$

$$f_k = \frac{1}{\sqrt{C_\mu}} \left(\frac{\Delta}{\Lambda} \right)^{\frac{2}{3}} > \frac{k_u}{k}$$

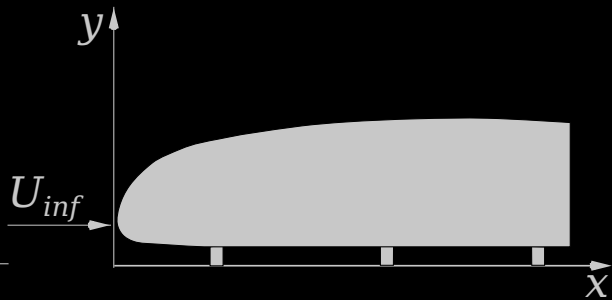
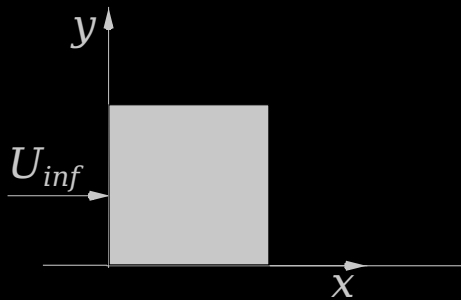
$\sqrt[3]{\Delta_x \Delta_y \Delta_z}$

$\frac{k^{3/2}}{\epsilon}$

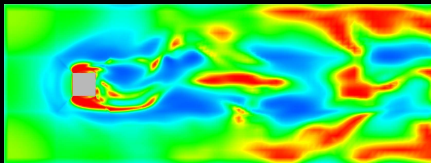
$$f_k = \frac{1}{\sqrt{C_\mu}} \left(\frac{\Delta}{\Lambda} \right)^{\frac{2}{3}} > \frac{k_u}{k}$$

$\sqrt[3]{\Delta_x \Delta_y \Delta_z}$

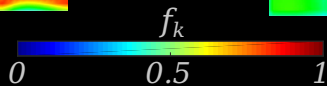
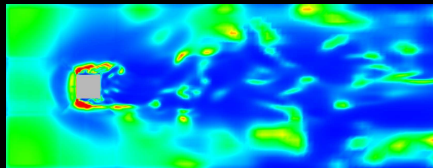
$\frac{k^{3/2}}{\epsilon}$



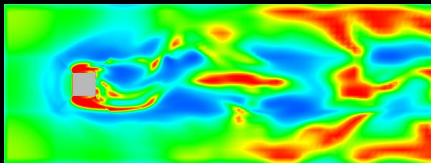
Coarse grid



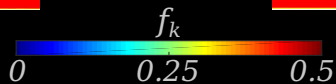
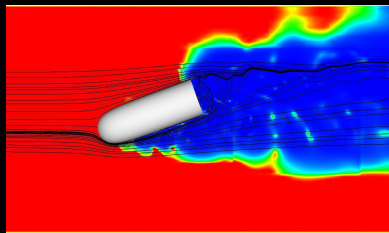
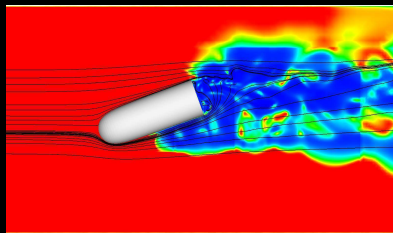
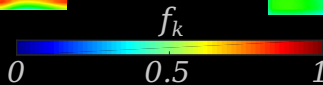
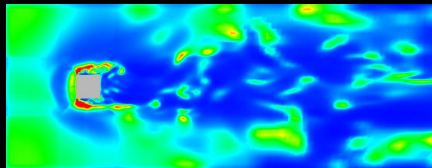
Fine grid



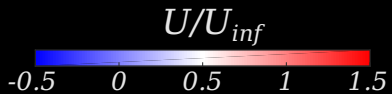
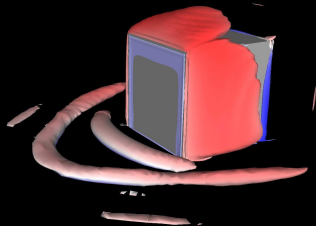
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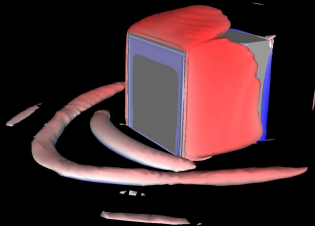
Fine grid



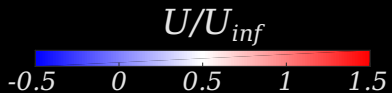
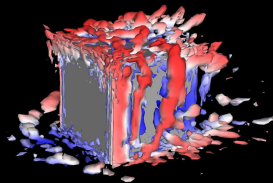
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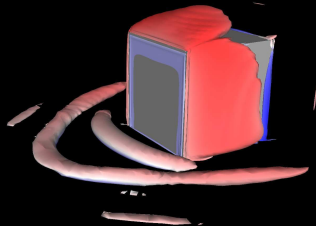
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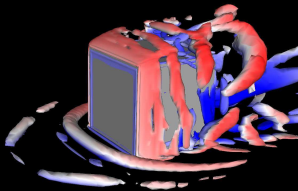
LES



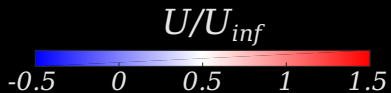
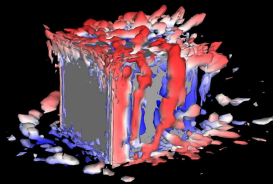
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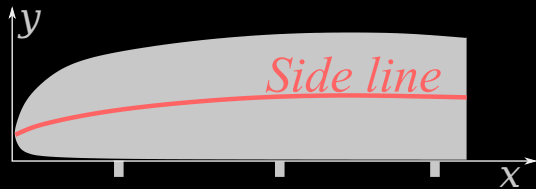
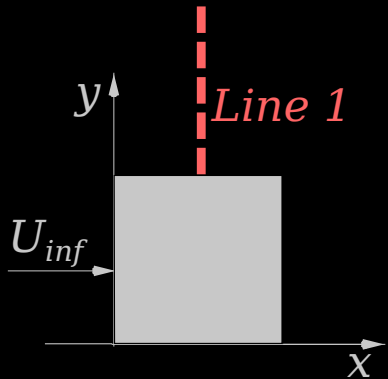


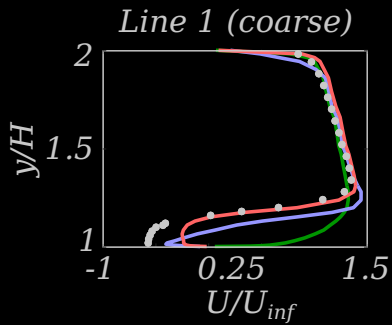
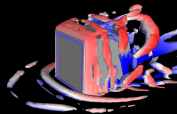
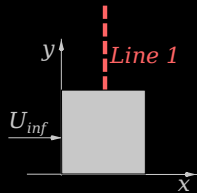
PANS

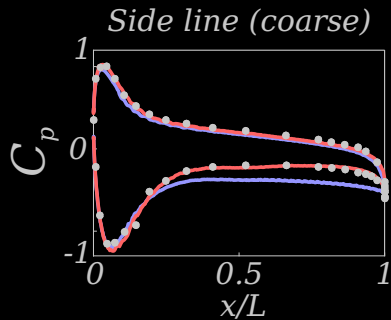
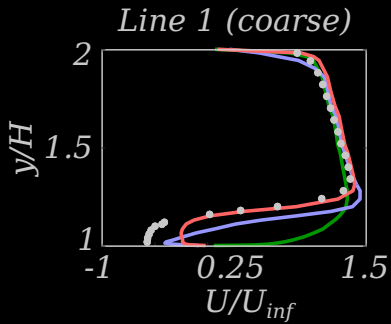
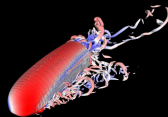
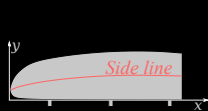
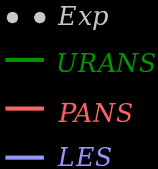
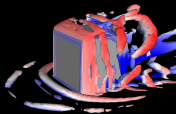
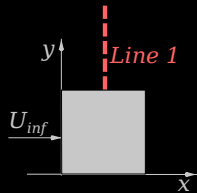


LES





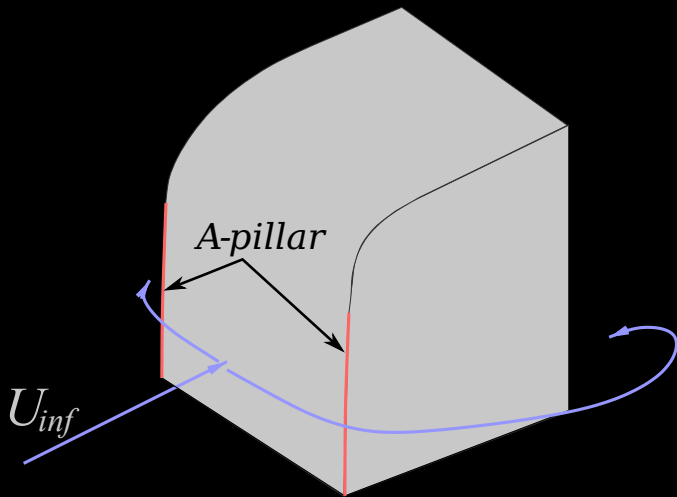


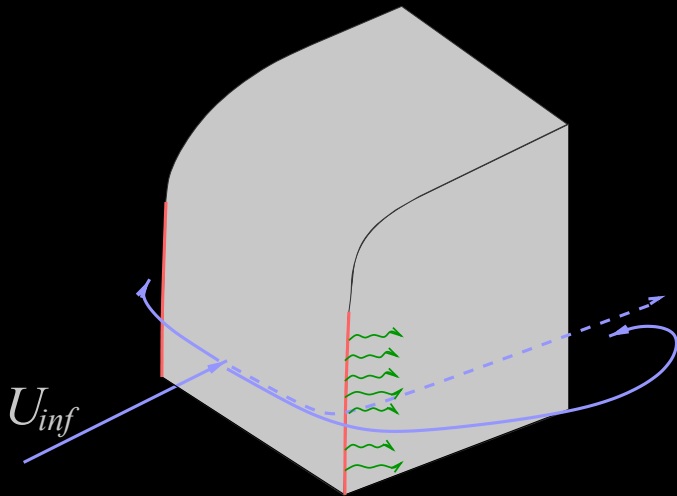


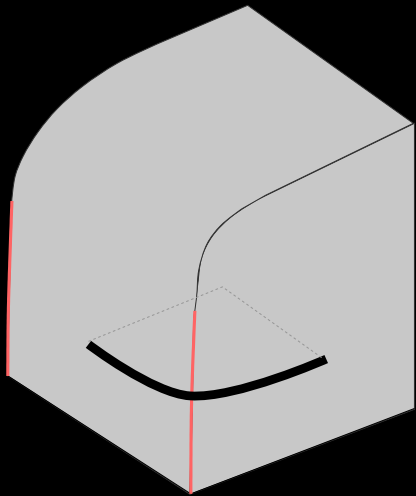


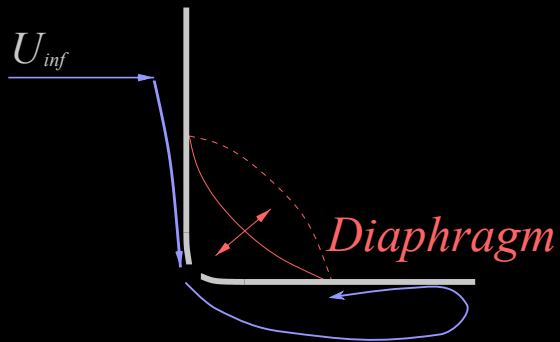
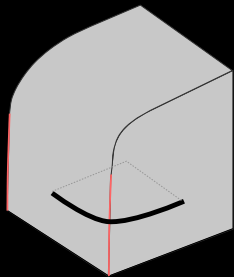


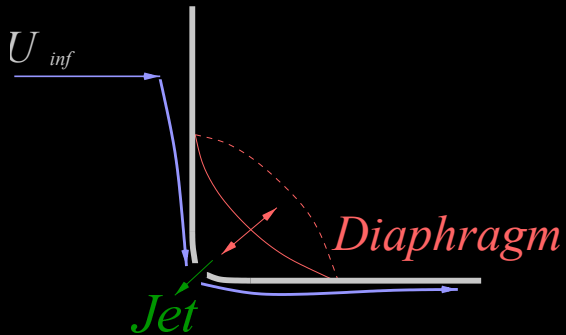
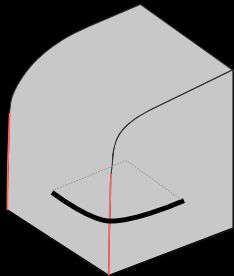
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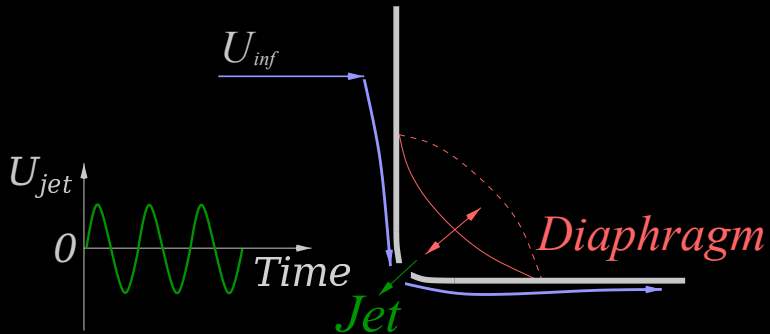
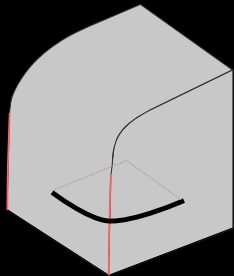


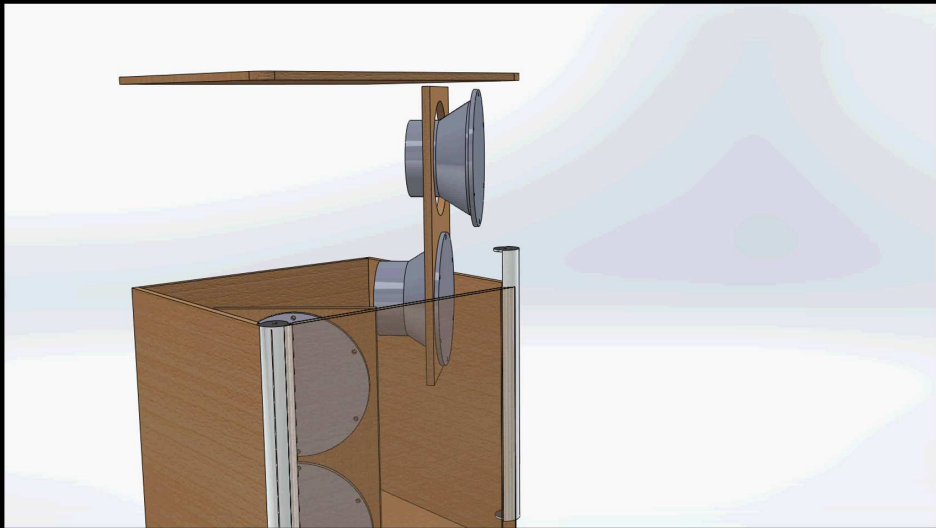


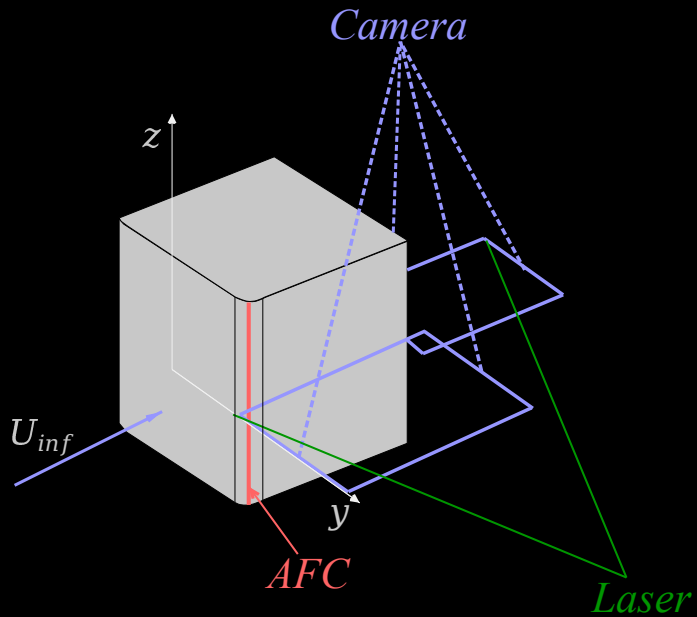


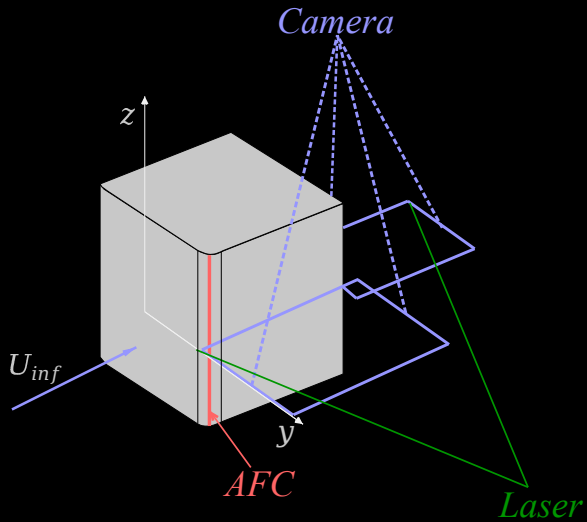




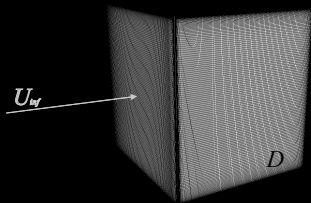




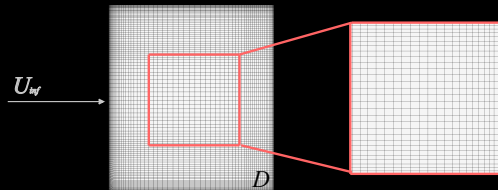
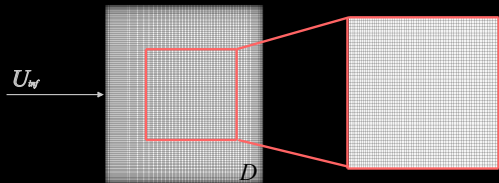
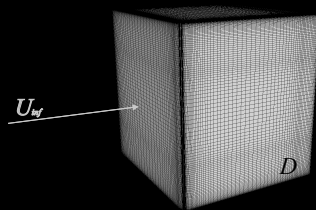


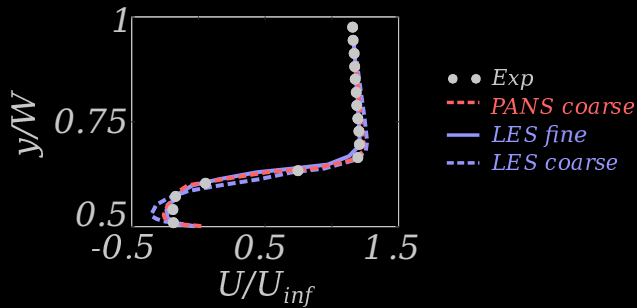
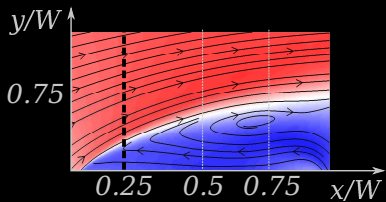
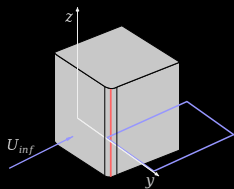


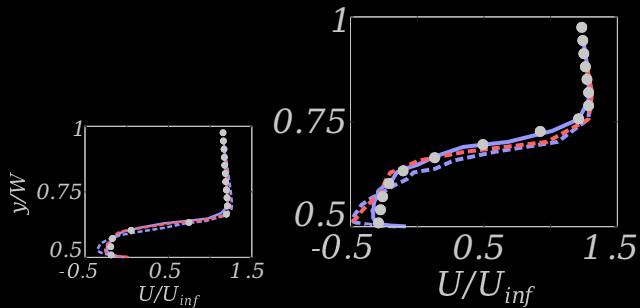
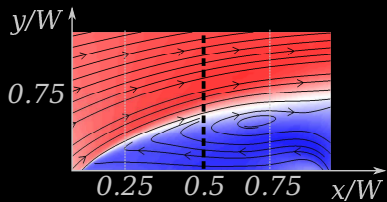
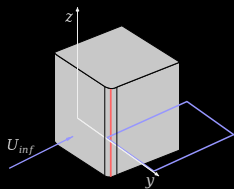
Fine (16 mil)

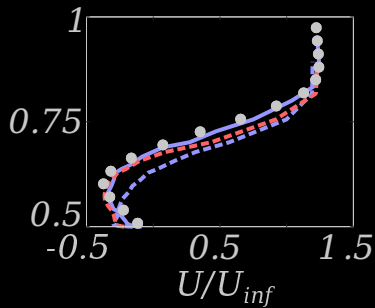
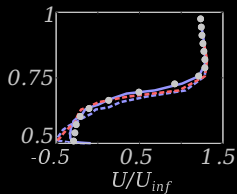
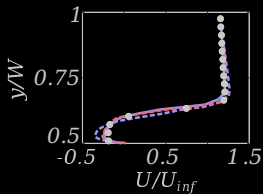
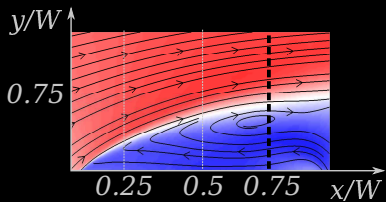
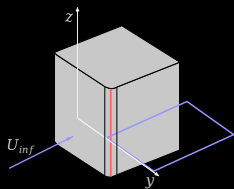


Coarse (4 mil)

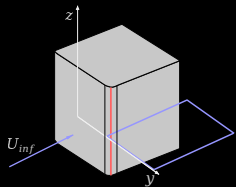




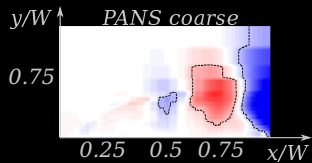
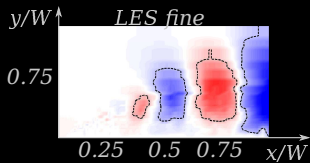
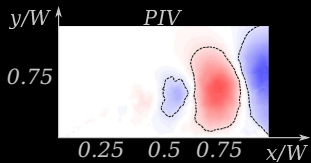


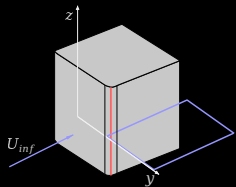


- • Exp
- PANS coarse
- LES fine
- - - LES coarse

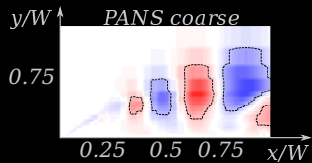
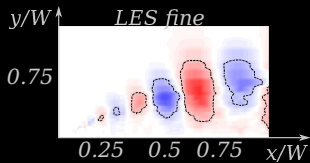
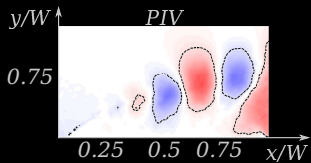


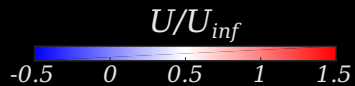
v component (y)
Mode 1

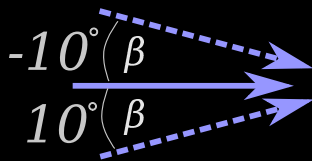




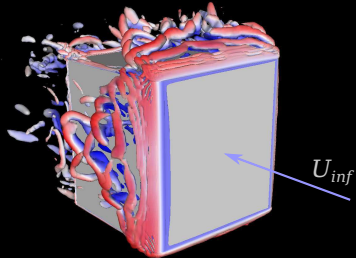
v component (y)
Mode 2



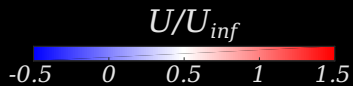
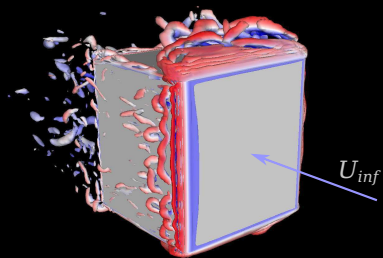


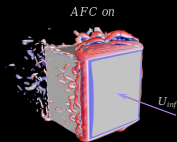
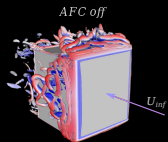


AFC off

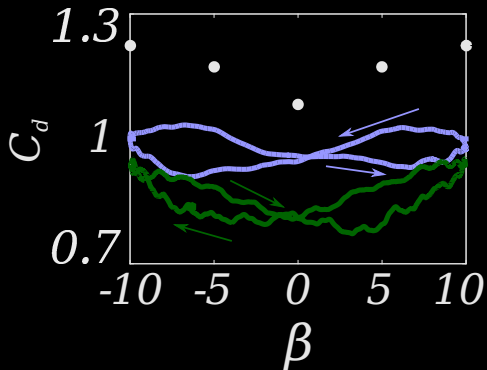


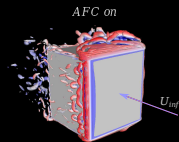
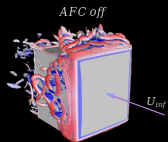
AFC on





• • *Stat* — *Dyn* — *Dyn Actuated*





• • *Stat* — *Dyn* — *Dyn Actuated*

